Wind-forced Intraseasonal Sea Level Variability of the Extratropical Oceans

Lee-Lueng Fu (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109)

Seven years' worth of wind observations from the ERS-1/2 scatterometers were used to investigate the dynamics of large-scale intraseasonal sea level variability at mid and high latitudes revealed in satellite altimetry data. Significant coherence was found between wind stress curl and sea level at periods from 20 days to a year in three particular regions: the Bellingshousen basin west of the Drake Passage, the area between Australia and Antarctica (south of 50° S), and the central North Pacific near the dateline (30°N-50°N). A special feature of these regions is the existence of closed, or nearly closed, f/H contours, where f is the Coriolis parameter (twice the earth's rotational rate multiplied by the sine of latitude) and H is the depth of the ocean. Sea level variability with horizontal gradients parallel to those of f/H is associated with motions along constant potential vorticity. The basic dynamics is governed by a barotropic vorticity equation, in which the relative vorticity is balanced by the forcing of wind stress curl and the dissipation at the ocean bottom. Based on this equation, sea level variations were simulated from the wind forcing. The simulations are correlated with the observations at 95% confidence level. A dissipation time scale on the order of 50 days was obtained from the calculations. The phase of the coherence between sea level and wind stress curl also showed dependence on frequency consistent with the dissipation mechanism and its estimated time scales.